

Amdt. dated : 11/29/04

Reply to Office Action of 8/25/04

PATENT
Docket: 010544**REMARKS**

Claims 1-32 are pending in the present application. In the above amendments, claims 1, 2, 5, 6, 9-12, 14-16 18-20, 23, 24, 27, 28, 30 and 31 have been amended. Therefore, after entry of the above amendments, claims 1-32 will be pending in this application. Applicants believe that the present application is now in condition for allowance, which prompt and favorable action is respectfully requested.

Objection to the Drawings

The drawings are objected to because of the following deficiencies:

1. "data sink 176" in FIG. 1 is missing a reference sign and is not labeled; and
2. "receiver unit 150" in FIG. 1 is missing a reference sign.

Corrected drawing sheets with the noted deficiencies corrected are being submitted herewith along with the present amendment.

Objection to the Claim

Claim 20 is objected to because the word "comprising" appears twice next to each other in the preamble of the claim. Claim 20 has been amended to correct this error.

Rejection of Claims 9, 10 and 12 Under 35 U.S.C. §112, Second Paragraph

Claims 9, 10 and 12 stand rejected under 35 U.S.C. §112, second paragraph as being indefinite because the term "D" is not defined in each of these claims. Claims 9, 10 and 12 have each been amended to recite "where D is a minimum distance of the (N, K) linear block code." Support for this amendment is given in paragraph 1029 of the specification.

Rejection of Claims 1, 4 and 13 Under 35 U.S.C. §103(a)

Claims 1, 4 and 13 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Weng (EP0407101 A2) in view of Katayama et al. ("One-Shot Reed-Solomon Decoding for High-Performance Dependable Systems."

Weng describes decoding of a data block that was previously encoded twice, "once horizontally for error detection and once vertically for error correction." (Page 1, lines 1-2.). Weng performs block decoding as follows.

"If the CRC decoding indicates that multiple CRC code words contain errors and one or more of the CRC code words is a data code word, the system first determines which of the columns contain errors. The system then engages in error correction for these particular columns.

To determine whether a particular column contains any errors, the system encodes the column data symbols using the Reed-Solomon code and thus generates new ECC redundancy symbols. It then adds (XOR's) these symbols to the corresponding ECC redundancy symbols retrieved from the tape to formulate remainder symbols... If one or more of the remainder symbols are non-zero the two sets of ECC symbols are not the same and the column contains one or more erroneous symbols. The system then performs error correction for each column containing errors." (Page 3, lines 45-55.)

Claim 1 of the present invention, as amended, recites:

"A method of performing erasure-and-error correction block decoding on a received block of symbols using erasure-only correction block decoding, comprising:

- obtaining the received block of symbols previously coded column-wise with an (N, K) linear block code and row-wise with an error detection code, the received block comprising N codewords in N columns;
- identifying a codeword with an undetected symbol error and corresponding to a column of the received block where the undetected symbol error is located;
- determining the location of the undetected symbol error in the codeword;
- marking a row of the received block containing the undetected symbol error as an erased row; and
- performing erasure-only correction block decoding on the received block with the marked erased row."

Applicants submit that claim 1 is patentable over Weng in view of Katayama for at least the following reasons.

First, Weng does not describe "marking a row of the received block containing the undetected symbol error as an erased row." Weng checks each column to determine whether that column contains any errors. Because each column is checked for errors individually, Weng does not mark an entire row as an erased row if an error is found in one column.

Second, Weng does not describe "performing erasure-only correction block decoding on the received block with the marked erased row." Instead, Weng performs error correction for each column containing errors. Error correction for individual columns is more computationally intensive than erasure-only correction for a block. The innovative block decoding of the present application is thus computationally efficient and is well suited, e.g., for software-based implementation, as mentioned in paragraph 1071.

Third, Katayama does not describe performing erasure-only correction block decoding with the erased row marked in the manner recited in claim 1. A row in a block is normally identified as either erased or un-erased based on a CRC generated for that row. In contrast, claim 1 recites identifying the erased row by (1) "identifying a codeword (or column) with an undetected symbol error" and (2) "determining the location of the undetected symbol error in the codeword". The innovative block decoding of the present application can be used even when the symbol error is undetected by the CRC.

Fourth, there is no teaching nor suggestion to combine Weng with Katayama. Weng describes performing error correction by using the error correction capability of the block code to actually correct errors. Katayama appears to describe performing erasure decoding, presumably with the erasures already identified by an error detection code, e.g., a CRC applied across rows. These are two different methods of performing block decoding and there is no suggestion in either reference to combine the two methods.

Furthermore, it is not apparent that the combination of Weng with Katayama would have resulted in the present invention as recited in claim 1. Claim 1 can achieve erasure-and-error correction even when the CRC fails to detect a symbol error and without having to perform error correction on the symbol error.

For at least the above reasons, Applicants submit that claim 1 is patentable over Weng in view of Katayama. Claims 4 and 13 are dependent on claim 1 and are patentable for at least the reasons noted for claim 1.

Accordingly, the §103(a) rejection of claims 1, 4 and 13 should be withdrawn.

Rejection of Claim 2 Under 35 U.S.C. §103(a)

Claim 2 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Weng and Katayama as applied to claim 1 and further in view of Nygren et al. (US 2002/0106190 A1). The rejection states that Nygren describes the limitations recited in claim 2.

Applicants submit that claim 2, which is dependent on claim 1, is patentable over Weng and Katayama in view of Nygren for at least the following reasons.

First, base claim 1 is patentable over Weng in view of Katayama for the reasons noted above.

Second, Nygren does not describe the features recited in claim 2. Nygren describes "processor 100 sequentially compares each column 154 of video pixels 150 associated with video data 106b with a corresponding column 154 of video pixels 150 associated with video data 106a." (Paragraph 0053 of Nygren.) Nygren does not describe "deriving an estimate of an un-erased systematic row of the received block" and using this estimate to determine the column containing the undetected symbol error.

Third, there is no teaching nor suggestion to combine Nygren with Weng and Katayama. Nygren describes video processing whereas Weng and Katayama describe block decoding, which are arguably two different fields.

Accordingly, the §103(a) rejection of claim 2 should be withdrawn.

Rejection of Claims 3, 14, 16, 17, 28 and 29 Under 35 U.S.C. §103(a)

Claims 3, 14, 16, 17, 28 and 29 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Weng, Katayama and Nygren as applied to claim 2 and further in view of Rizzo, Luigi ("On the Feasibility of Software FEC").

As per dependent claim 3, the rejection states that Rizzo describes the additional limitations recited in this claim. Applicants submit that claim 3, which is dependent on claim 2, is patentable over Weng, Katayama and Nygren in view of Rizzo for at least the following reasons. First, claim 2 is patentable over Weng and Katayama in view of Nygren for the reasons noted above. Second, Rizzo does not describe all of the features recited in claim 3. Rizzo describes deriving one data word \underline{x} (which corresponds to one column of the received block) based on a received code word $\underline{y'}$. Rizzo does not describe deriving an estimate of the un-erased systematic row (which spans across N columns) using K un-erased rows of the received block.

These K un-erased rows would not include the un-erased systematic row that has been marked as an erased row so as to not be selected for the reduced received block.

As per independent claim 14, the rejection states that the combination of Weng, Karayama, Nygren and Rizzo describe all of the features of claim 14. Applicants submit that claim 14 is patentable over these four references for at least the following reasons. First, Weng does not describe "marking a row of the received block containing the undetected symbol error as an erased row," as the rejection states. Rather, Weng checks each column individually for errors. Second, Rizzo does not describe "marking each row of the received block as either an erased or an un-erased row until at least (K+1) un-erased rows are found," as the rejection states. In Figure 1, page 3, Rizzo shows one column for a code word x instead of a block. Third, Nygren does not describe "deriving an estimate of an un-erased systematic row of the received block," as the rejection states. Instead, Nygren describes comparing columns of video pixels. A column of video pixel is not the same as a systematic row of a data block that has been block coded. Fourth, Katayama does not describe performing erasure-only correction block decoding on the received block with the erased row marked as recited in claim 14.

Claims 16 and 28 recite features similar to those recited in claim 2 and should be patentable for the reasons noted above for claim 2.

Claims 17 and 29 recite features similar to those recited in claim 3 and should be patentable for the reasons noted above for claim 3.

Accordingly, the §103(a) rejection of claims 3, 14, 16, 17, 28 and 29 should be withdrawn.

Rejection of Claims 5-7, 15, 18, 24-27 and 30 Under 35 U.S.C. §103(a)

Claims 5-7, 15, 18, 24-27 and 30 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Weng and Katayama as applied to claim 1 and further in view of Rizzo.

Claims 5-7 are dependent on claim 1 and are patentable for at least the reasons noted above for claim 1.

Independent claims 15, 24 and 27 recite features similar to those recited in claim 1. Claim 18 is dependent on claim 15, claims 25 and 26 are dependent on claim 24, and claim 30 is dependent on claim 27. These claims are patentable for at least the reasons noted above for claim 1.

Accordingly, the §103(a) rejection of claims 5-7, 15, 18, 24-27 and 30 should be withdrawn.

Rejection of Claims 8-12 Under 35 U.S.C. §103(a)

Claims 8-12 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Weng and Katayama as applied to claim 1 and further in view of Spruyt (US Patent No. 5,636,253).

As per claim 8, the rejection states that Spruyt describes "determining the number of erased rows in the received block" (column 1, lines 6-8 and lines 28-35). This section simply states that it is advantageous to be able to detect for erasures. As per claims 9-11, Spruyt and Katayama do not describe performing erasure-only correction block decoding or erasure-and-error correction block decoding based on the number of erased rows in the received block.

Claim 12 has been amended to be in independent form and to recite performing erasure-only correction block decoding or erasure-and-error correction block decoding based on the number of erased rows and the number of erased systematic rows in the received block. Weng, Katayama, Rizzo, Nygren, and Spruyt do not describe this.

Accordingly, the §103(a) rejection of claims 8-12 should be withdrawn.

Rejection of Claim 19 Under 35 U.S.C. §103(a)

Claim 19 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Weng in view of Katayama and Campana Jr. (U.S. Patent No. 5,446,759).

Independent claim 19 recites features similar to those recited in claim 1. Claim 19 is thus patentable for the reasons noted above for claim 1.

Accordingly, the §103(a) rejection of claim 19 should be withdrawn.

Rejection of Claims 20, 22 and 23 Under 35 U.S.C. §103(a)

Claims 20, 22 and 23 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Weng in view of Katayama and Rizzo.

Independent claim 20 recites features similar to those recited in claim 1. Claims 22 and 23 are dependent on claim 20. Claims 20, 22 and 23 are thus patentable for at least the reasons noted above for claim 1.

Accordingly, the §103(a) rejection of claims 20, 22 and 23 should be withdrawn.

Rejection of Claim 21 Under 35 U.S.C. §103(a)

Claim 21 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Weng, Katayama, Campana Jr. and Rizzo as applied to claim 20 and further in view of Nygren.

Claim 21 is dependent on claim 20 and recites features similar to those recited in claim 2. Claim 21 is thus patentable for the reasons noted above for claim 2.

Accordingly, the §103(a) rejection of claim 21 should be withdrawn.

Rejection of Claim 31 Under 35 U.S.C. §103(a)

Claim 31 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Weng in view of Katayama, Rizzo and Spruyt.

Independent claim 31 recites features similar to those recited in claim 1 and is thus patentable for the reasons noted above for claim 1.

Accordingly, the §103(a) rejection of claim 31 should be withdrawn.

Rejection of Claim 32 Under 35 U.S.C. §103(a)

Claim 32 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Weng, Katayama, Rizzo and Spruyt as applied to claim 31 and further in view of Hartman Jr. (U.S. Patent Application Serial No. US2002/0075830 A1).

Claim 32 is dependent on claim 31 and is thus patentable for the reasons noted above for base claim 31.

Accordingly, the §103(a) rejection of claim 32 should be withdrawn.

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CONCLUSION

In light of the amendments contained herein, Applicants submit that the application is in condition for allowance, for which early action is requested.

Please charge any fees or overpayments that may be due with this response to Deposit Account No. 17-0026.

Respectfully submitted,

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